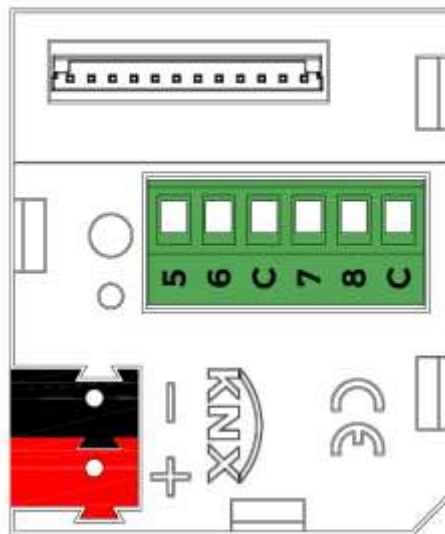


## Product Handbook

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AD84C01KNX | Analog / Digital Module 8 Input / 4 led Output

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Document

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Any information inside this manual can be changed without advice.

This handbook can be download freely from the website: [www.eelectron.com](http://www.eelectron.com)

Exclusion of liability:

Despite checking that the contents of this document match the hardware and software, deviations cannot be completely excluded. We therefore cannot accept any liability for this.

Any necessary corrections will be incorporated into newer versions of this manual.

Symbol for relevant information



Symbol for warning



**DISPOSAL** : The crossed-out bin symbol on the equipment or packaging means the product must not be included with other general waste at the end of its working life. The user must take the worn product to a sorted waste centre, or return it to the retailer when purchasing a new one. An efficient sorted waste collection for the environmentally friendly disposal of the used device, or its subsequent recycling, helps avoid the potential negative effects on the environment and people's health, and encourages the re-use and/or recycling of the construction materials

## 1. General introduction

This manual is intended for use by KNX® installers and describes functions and parameters of the AD84C01KNX module and how you can change settings and configurations using the ETS software tool.

The AD84C01KNX device is a inwall module with 8 inputs and 4 LED outputs.

The 8 inputs are for dry contacts (free from potential); inputs from 1 to 4 are digital, inputs 5 to 8 can be configured as digital or analogical to interface NTC temperature probes (code eelectron TS01A01ACC or TS01B01ACC).

The outputs can drive low voltage LEDs; use high efficiency LED code eelectron LD00A01ACC (blue) or LD00A11ACC (white).

The AD84C01KNX module is designed for use in domestic and building installations (eg offices, hotels, private homes, etc.).

## 2. Product overview

### Main functions digital inputs 1 ÷ 8

Digital inputs can be connected to buttons or switches and can be used for:

- 1-bit commands: loads activation / deactivation commands (ON / OFF / TOGGLE) with short pressure or with long and short pressure differentiation
- 1 byte commands (0-255 or HVAC commands or % value commands).
- Sending long action telegrams to the same short action address or to a different group address
- Commands for cyclic sending
- Sequences (3 commands that mix 1 bit / 1 byte objects) with different group addresses - in short and long press mode or in switching mode
- Dimmer management (with single button or with double button)
- Roller shutters and blinds management (with single button or with double button)

- Control sequences with 1 bit to manage switching on / off lights or rows of lights
- Input counters (only inputs from 1 to 4)
- RGB color setting with fixed value (short pressure) or color change (long pressure); 1 byte datapoint or 3 byte selectable
- MUR / DND (Make Up Room - / Do Not Disturb), function with built-in logics
- Loop function between values to send step by step a sequence of values of 1 byte

### Main functions analog inputs 5 ÷ 8

Inputs 5 to 8 can be configured as analogue for the connection of NTC temperature probes

It is possible to enable 4 complete thermostats modules; each thermostat module manages 2 stages with integrated PI controller for driving heating and cooling equipment, valves, 2 and 4 pipe fan coils, etc..

NTC probes :

For NTC temperature probe the following eelectron code accessories must be used:



TS01A01ACC (from -20°C to +100°C)  
TS01B01ACC (from -50°C to +60°C)

NTC probes main functions:

Configured as temperature sensors (4 sensors) - main functions:

- 2 different temperature thresholds to activate alarms / warnings with 1 bit telegrams
- Enable / disable alarms / alerts via 1-bit objects

Configured as thermostats (4 thermostats) - main functions:

- Different Control Algorithms: 2-point on / off; PWM; continuous control / Fan Coil control
- Different modes of operation mode setting: Automatic HVAC / HVAC Manual / Setpoint
- Additional command for 2nd stage management
- Window contact management
- Additional external probe (optional)

### Logic function and Virtual Holder function

The device includes some logic functions and a logic for the automatic detection of the presence in room called "Virtual Holder"

### Logics - main functions

- 2 input object and 1 output obj for every logic
- Delay, retransmission of telegrams
- NOT / AND / OR / NAND / NOR / XOR / XNOR
- Bit to Byte conversion
- Byte to Bit conversion
- 1,2,4 Bytes Threshold
- Free expressions with 4 input objects and 1 out object

## 3. Installation instructions

The device may be used for permanent indoor installations in dry locations within wall box mounts.



### WARNING

- Device must be installed keeping a minimum distance of 4 mm between electrical power line (mains) and input cables or red / black bus cable.
- The device must not be connected to 230V cables
- The prevailing safety rules must be heeded.
- The device must be mounted and commissioned by an authorized installer.
- The applicable safety and accident prevention regulations must be observed.
- The device must not be opened. Any faulty devices should be returned to manufacturer.
- For planning and construction of electric installations, the relevant guidelines, regulations and standards of the respective country are to be considered.
- KNX bus allows you to remotely send commands to the system actuators. Always make sure that the execution of remote commands do not lead to hazardous situations, and that the user always

has a warning about which commands can be activated remotely.

For further information please visit:

[www.eelectron.com](http://www.eelectron.com)

## 4. Parametri Generali

KNX PARAMETER	SETTINGS
Delay on Power-up	5 ÷ 15 seconds
Through this parameter is possible to set the delay of transmission of telegrams after a power on by selecting the time by which the device is allowed to send telegrams. In large systems after a power failure or shutdown this delay avoids to generate excessive traffic on the bus, causing slow performance or a transmission block. If there are different devices requiring sending telegrams on the bus after a reset, these delays must be programmed to prevent traffic congestion during the initialization phase. The input detection and the values of objects are updated at the end of the transmission delay time At the end of ETS programming the device behaves like after a power on.	
Virtual holder	disabled / enabled
By setting this parameter, you can enable a "virtual holder", that is, a logical function that automatically recognizes the presence of a person in a room. This feature can be used in hotel or similar installations and requires connection to other devices.	
Enable alarm obj. inp. <x>	disabled / enabled
By setting this parameter, a 1-bit communication object is shown which is used to signal a malfunction related to the temperature sensor.	

## 5. Inputs configuration

Inputs 1 to 4 are digital, while inputs 5 to 8 can be configured as digital or analogical to interface NTC temperature probes.

## 6. Digital inputs

With DIGITAL INPUT configuration each individual input can be configured to perform one of the following functions:

- Activation on press
- Activation on press / release
- Activation on short and long press
- Dimming
- Shutter and blinds
- Scene
- Command sequences (short and long press)
- Command sequences (toggle function)
- Command sequences 1 bit
- Input counter (pulse counter)
- Set RGB color
- MUR/DND function
- Loop among values

### Activation on press

“**Activation on press**” allows you to configure the sending of telegrams when the button is pressed; device can also be configured to send periodic messages with repetition period.

KNX PARAMETER	SETTINGS
Telegram Associated	1 bit / 1 byte
It is possible to send 1 bit or 1 byte objects	

Configurations for 1 bit object:

- On
- Off
- Toggle

Configurations for 1 byte object:

- Value 0-255 (generic signed int)
- Value 0-100% (scaling value in steps of 5%)
- HVAC Mode (DPT\_HVACMode 20.102)

KNX PARAMETER	SETTINGS
Cyclic sending when button pressed	Never 0.3 sec. 0.4 sec. 0.5 sec. 0.8 sec. 1.0 sec. 1.2 sec. 1.5 sec. 2.0 sec. 3.0 sec. 5.0 sec. 8.0 sec. 10 sec.
As long as the button is pressed, the telegram with selected size and value is sent cyclically; this parameters defines the time interval between two sendings	

### Activation on press / release

“**Activation on press / release**” allows you to configure the sending of telegrams when the button is pressed and when it is released.

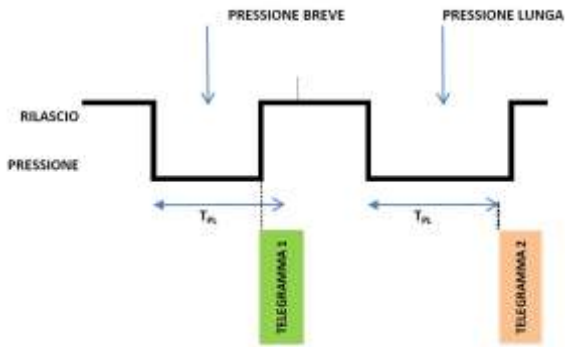
**Parameters are identical to the choice “activation on press”; one parameter is added:**

KNX PARAMETER	SETTINGS
Communication object on release	disabled / enabled
if enabled, this parameter displays an additional communication object (<Button x> Release Action) that is transmitted on the release event, this object can be associated with a group address other than the one that sends the value associated with the pressure.	

### Activation on short and long press

The different duration between short and long press is defined by the parameter “Minimum time long **press button**”.

You can set to send a telegrams with different values on short and long press or decide to send commands only on one of this events.



When button is pressed then counting time starts; if the button is released before time exceeds TPL time, device executes the command associated with the event of "short press" and if, on the contrary, TPL timeout expires and button is still pressed then the command associated with the event of "long press" is executed.

The parameters and mode of transmission of telegrams can be managed through "activation on long and short press" are the same set with the configuration "Activation of press / release " except for the function of cyclic sending that is not provided here.

## Dimming

Through the dimming function it's possible to control a light dimmer using short and long press of the buttons.

Each button uses 2 communication objects:

1 bit dimension for ON /OFF command associated to short press operation

4 bit dimension for brightness regulation associated to long press operation

Parameter "Minimum time long press button" can set the minimum duration of long press; "Dimming mode" and "Dimming step" can define brighter or darker behaviour and step of each long press action.

## Shutter and Blinds

Through the Shutter and Blind function it's possible to control Roller Shutters or Blinds using short and long press of the buttons.

Each input uses 2 communication objects:

1 bit dimension for STEP /STOP command associated to short press operation

1 bit dimension for UP / DOWN command associated to long press operation

Parameter "Minimum time long press button" can set the minimum duration of long press; "Command drive shutter" can define up or down behaviour associated to long press action.

## Scene

In this configuration page it's possible to set the button for scene management: learn and recall scene commands.

These different behaviour (recall and learn) are performed through two different actions (short and long press) of the button.

Learn scene on long press action is enabled by a parameter; "Minimum time long press button" can set the minimum duration of long press.

KNX PARAMETER	SETTINGS
Scene Number	Number of the scene: 0 ÷ 63
This parameter sets the value of the scene you intend to learn / recall (one per channel). Remember that output devices (i.e. actuators, etc.) generally can manage several scenes, each identified by a value (that varies from 0 to 63); therefore is important to set this parameter correctly and matching the number set on the actuators.	
Store scene on long press	disabled / enabled
If disable, long press action is ignored and no telegram is sent to the bus; if enable on long press action a learn scene telegram is sent to the bus.	



Object enable scene learning from bus	disabled / enabled
<p>If this parameter is enabled you have a communication object (size = 1 bit) in order to enable / disable runtime <b>from bus the sending of the "learn scene telegram"</b>. When this object receives a telegram "1" then the function associated to the long press of the button (send the telegram storage scenario) is enabled, when <b>it receives a telegram "0" the command associated with the long press is not sent.</b></p>	

## Commands sequences

This function allows you to associate to short and long press, sequences of different commands on the bus.

For each button this function is available for short and long press or as toggle function.

The sequence consists of 2 or 3 commands which can each be sized as 1 bit or 1 byte.

Once defined the number of elements in the sequence (2 or 3) and their size (1-bit / 1 byte), you can associate different commands to each element of the sequence or decide to send commands only on one of the two events.

The waiting time between a command and the next is fixed in 1 second.

Each object communication can be connected to a different group address.

For example it is possible to define a sequence:

obj	dimension	short press (operation 1)	long press (operation 2)
A	1 bit	ON (to actuators)	OFF (to actuators)
B	1 byte	100% (to a dimmer)	0% (to a dimmer)
C	1 byte	COMFORT (to a thermostat)	ECONOMY (to a thermostat)

## Command sequences (1 bit)

This function allows you to send sequences of 1-bit commands to multiple objects. The sequence can be defined on 2 or 3 objects. Each time the switch/button connected to the input is pressed, the next step of the defined sequence is sent.

KNX PARAMETER	SETTINGS
Number of objects	2, 3
This parameter defines the number of 1-bit objects that will be visible and will send values 0 or 1 on the bus	
Number of steps in the sequence	2 ÷ 8
Indicates the number of steps of which the sequence is made up.	
Long press to restart sequence	disabled/enabled
Allows to associate to a long pressure of the switch/button connected to input channel an action of "restart" of the sequence.	
Restart function	Restart and send first Send long step and restart

Restart and send first The long press determines the sending of step 1 Send long step and restart The long press determines the sending of the next step and brings the sequence to the initial step.	
Send only changed objects	disabled/enabled
This parameter defines whether, in the transition from one step to the next, all values associated with single-bit objects or only those that change are to be sent.	
Value step <x>	<i>On and off combinations on 2 or 3 1-bit objects</i>
Determines the combination associated with a sequence using 2 or 3 1-bit objects.	

## Input counter (pulse counter)

Using the Input Counter function it is possible to count the pulses of a contact connected to the input. It is possible to define the size of the counter (1,2 or 4 Bytes), the initial value and the final value. It is possible to associate the sending of a value with 1 bit or 1 byte each time the counter reaches the final value (overflow). the counter can be reset by an writing on a dedicated 1-bit object.

Using the "Condition of increase counter" parameter, you choose whether to count only the rising, falling or both edges.

The parameter "Software filter frequency " allows to manage a software filter that allows to count 2 pulses too close each other as a single impulse; this is necessary when the contact connected to the input has a debounce for a certain time.

## Set RGB color

This function allows you to associate a short press of the button to a command on the bus in order to set a RGB color. The "RGB object type" parameter defines whether the command is sent with a single 3-byte object or 3x1-byte objects. It is also possible to enable a feature associated with a long press that allows to change the color which is sent with a short press. During long press the color transition is performed and at the time of release the selected color is stored; this means that from now every time

a short press is done the new color is sent on the bus. When the device is powered off and on the last selected color is kept in memory. The "Enable sending color during transition" option allows you to send all color transitions during long press so that each color can be displayed on another device.

## MUR / DND

This function allows you to configure a input to send 1-bit commands with DND (do not disturb), MUR (make up room) or reset both signals - according to the sequence described below.

**Value of parameter "command associated"** (column "cmd") defines which values are sent on the 2 x 1 bit objects

cmd	Action	DND	MUR	Note
MUR	enable	0	1	<b>MUR co sends "1"</b> <b>DND co sends "0"</b>
MUR	disable	-	0	<b>MUR co sends "0"</b>
MUR	toggle	MUR enable/disable alternate		
DND	enable	1	0	<b>DND co sends "1"</b> <b>MUR co sends "0"</b>
DND	disable	0	-	<b>DND co sends "0"</b>
DND	toggle	DND enable/disable alternate		
Loop		0	1	Loop among these 3 sets
		1	0	
		0	0	

It is possible to associate a color to each of the 3 states (DND active, MUR active, MUR & DND not active); **it's also possible to send the same color** on the bus using a 3Byte Object DPT 232.600 RGB value 3x(0..255)

## Loop among values

With this function you can configure a button to send a 1-byte value in sequence. The sequence is composed of a number of values between 3 and 9.

Each time a pressure (or release according to the "active edge" parameter) is done a value is sent following the order set in ETS: from the first (A) to the last (I).

Two object are available:

<Input x> Loop Value Output	1 byte - 0..255  CW
This object is sto send the values of the sequence	
< Input x> Loop Value Feedback:	1 byte - 0..255  CRT
this object is to receive a value from the bus; if it corresponds to a value set in the sequence it bring the same to the corresponding step.	

## 7. Led output

Each output can be connected to a LED (see LED eelectron code LD00A01ACC / LD00A11ACC) and configured as:

Always OFF	Led is OFF
Always ON	Led is ON
Bus controlled	Led is lit on or off upon the telegram receive from bus ; initial state and led behaviour (fixed or blink) can be configured

## 8. Analog inputs

For inputs 5, 6, 7 and 8, if configured as analog inputs for temperature probe, the NTC probes code eelectron must be used:



TS01A01ACC (da -20°C a +100°C)

TS01B01ACC (da -50°C a +60°C)

**Maximum connection cable length: ≤ 20 m** (twisted cable)

At each input it is possible to associate the Temperature Sensor function or the Thermostat function

TS01A01ACC

Dimensions in millimetres  
NTC resistance tolerance: ± 3%  
Measure range: -20°C ÷ +100°C  
Cable: 2 wire single insulation  
Cable colour: Black  
NTC colour: Black

Warning:  
keep at least 6 mm from all live parts

TS01B01ACC

D1 = 9 mm D2 = 4 mm L2 = 49 mm L1 = 1250 mm  
NTC resistance tolerance: ± 2%  
Measure range: -50°C ÷ +60°C  
Cable: 2 wire double insulation  
Cable colour: White  
NTC colour: White

Warning:  
keep at least 3 mm from all live parts

## Temperature sensor - description

Using the "temperature probe" module it is possible (by connecting the NTC probe) to measure the temperature and send ON / OFF commands.

The objects available are as follows:

<Temperature x> Actual Temp.	2 bytes   CRT
Send temperature measurement in °C on variation and / or cyclically.	
<Temperature x> KNX probe Temp.	2 bytes   CW
The measurement of another probe is received via KNX	
<Probe x> Setpoint Upper	2 bytes   CW
Receives the upper setpoint via KNX bus	
< Probe x> Telegram Upper	1 bit   CRT
Send On, Off or nothing when going up or down the set upper threshold	
< Probe x> Setpoint Lower	2 bytes   CW
Receives the lower setpoint via KNX bus	
< Probe x> Telegram Lower	1 bit   CRT
Send On	
< Probe x> Enable Input	1 bit   CW
Enables or disables the sending of on / off telegrams	

## Temperature sensor - parameters

KNX PARAMETER	SETTINGS
Activation telegram	Telegram 0 Telegram 1
Definisce quale <b>valore del telegramma abilita l'invio dei telegrammi on/off</b> di soglia.	
State after download	disabled/enabled
Defines whether the sending of on / off telegrams is enabled or disabled after downloading.	
Hysteresis	0.5°C      1.0°C 2.0°C      5.0°C
Defines the hysteresis value to be applied on the high and low thresholds	
Upper setpoint value	-20°C ÷ +100°C TS01A01ACC -50°C ÷ +60°C TS01B01ACC
Lower setpoint value	-20°C ÷ +100°C TS01A01ACC -50°C ÷ +60°C TS01B01ACC
Telegram when value is above setpoint	off / on / nothing
Telegram when value is below setpoint	off / on / nothing
Cyclic sending time of telegrams	No cyclic send    30 min 1 hour              2 hours

## 9. Thermostat Function

The temperature function can be configured as a thermostat to control the temperature of a room or area by driving heating or cooling equipment / air conditioning fan coils / valves or through commands on / off to heating /cooling elements such as radiators, heat pumps, split, etc. ..



Setpoint values (including SETPOINT MODE) from the bus are accepted in a range from 10°C to 50°C

### Setpoint Settings

The control setpoint can be changed by bus in two different ways, via one of these objects:

HVAC Mode  
SETPOINT Mode

The right policy to adopt depend from the device that acts as a master, a time thermostat, a control panel or a SW supervisor. Here the list of object for changing the active mode or setpoint value by bus.

### SETPOINT Object

When "Thermostat control mode" parameter is selected with the value SETPOINT MODE, object HVAC Mode is no longer visible.

Each time the thermostat receives a value on object SETPOINT MODE ( 2 byte size), it is used as setpoint for temperature control.

### HVAC MODE obj. (switched heat / cool)

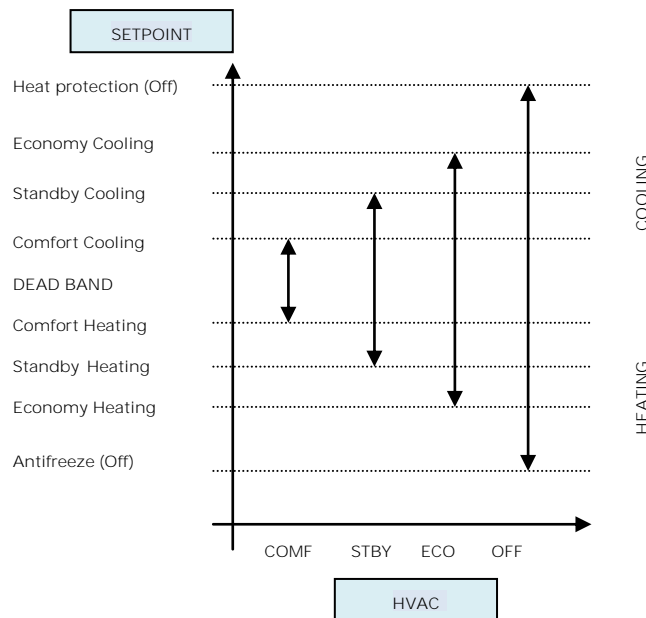
Using the HVAC MODE object (size 1 byte), it is possible to set the thermostat in one of the following modes: OFF; ECONOMY; STANDBY; COMFORT; each mode is associated with a setpoint set by an ETS parameter.

OFF mode is associated with the antifreeze setpoint in heating mode and at the high temperature protection set point in cooling mode.

### HVAC MODE obj. (automatic heat / cool)

**Behaviour for this value of parameter "Thermostat control mode" is the same as above described but the switching from heating to cooling mode and vice versa is automatic. With this setting it is necessary to set an insensitive zone as in parameter "Dead zone".**

Whenever temperature becomes greater than :  $Setpoint\ comfort\ heating + (Dead\ Band / 2)$  active control is cooling; when temperature becomes less than:  $Setpoint\ comfort\ cooling - (Dead\ Band / 2)$  active control is heating.



### SETPOINT COMFORT, STANDBY, ECONOMY

These 2 byte objects are used to set the setpoint values for COMFORT, STAND-BY, ECONOMY mode. Whenever change, the setpoint are in saved in memory. After download these setpoint are reset to values according to ETS parameter; on power up these

object are set according to last values before power down.



Use these communication objects to change current setpoint for every HVAC Mode according to the current active control (heating or cooling)

KNX PARAMETER	SETTINGS
Action to execute for setpoint	modify relative modify absolute
If you set this parameter to " modify relative ", the thermostat will take into account the new value set but will still consider the setpoint set in ETS as a reference to determine the allowed variation range ( $\pm 1, \pm 2, \pm 3, \dots$ ); choosing instead the value "absolute change" also this range will be recalculated.	

### COMFORT Object

COMFORT object (1 bit size) is visible only when "Thermostat control mode" parameter is selected with the value HVAC MODE.

When a telegram "1" is received thermostat goes in COMFORT mode (it applies for both heating and cooling)

On receipt of a telegram "0", thermostat returns to the mode set by HVAC MODE object.

COMFORT mode can be set also with timing: after a time set by a parameter thermostat returns in the previous mode.

KNX PARAMETER	SETTINGS
Comfort Object	Time limited Time unlimited
Comfort Overwrite Time	1.. 255 (minutes)

### WINDOW CONTACT Object

This object, if enabled, has higher priority than HVAC MODE, SETPOINT MODE, COMFORT objects.

When a telegram is received ("0" or "1") on the communication object WINDOW CONTACT thermostat enters a power saving mode: BUILDING PROTECTION (if running in HVAC MODE) or Setpoint antifreeze /high temperature protection (if running in SETPOINT MODE)

If the telegram received indicates that the window is opened, thermostat change its mode or setpoint after 1 minute from the reception of the telegram. When it receive a telegram corresponding to state "window closed" it restores the previous mode, always with a delay of 1 minute . The value of SETPOINT ADJUSTMENT (if enabled) is always restored.

### SETPOINT ADJUSTMENT object

The object SETPOINT ADJUSTMENT allows you to temporarily change the setpoint value used by the thermostat applying an offset to the current value. If the thermostat is operating in "HVAC MODE" the offset value is applied from the time of receipt of a valid telegram on object SETPOINT ADJUSTMENT until this value does not change, even in case of change of the active mode (Comfort and Standby); when device enters Economy mode this value can **be reset or not according to the parameter "Reset delta setpointon HVAC economy)**. Entering Building Protection mode the value of object SETPOINT ADJUSTMENT is forced to 0. Similarly, if the thermostat is operating in SETPOINT MODE the offset value is applied also when the setpoint value received on this object changes.

### KNX probe temperature obj.

It is possible to enable the reading of a second external probe which sends the measurement data to the thermostat via the communication object ADDITIONAL TEMPERATURE of size 2 bytes.

Surveillance time for KNX probe	10..255 (min)
Whenever the thermostat receive a valid data from KNX probe it consider this value in the calculation of the measured temperature and reset the internal time (monitoring time).	



If KNX probe is enabled the monitoring time is used to check if the additional temperature sensor periodically sends valid data to the thermostat. This mechanism avoids to consider as valid some data which can be old hours or days, for example if the additional sensor should fail or the thermostat could not receive data for long time.



It is strongly recommended to set a value for surveillance time of the additional sensor more than twice of the period set for the cyclical sending of the additional sensor.

### ACTUAL SETPOINT object

The ACTUAL SETPOINT object send the setpoint in use and is sent every time:

- The value of HVAC mode object changes
- The value BASE SETPOINT changes
- The value of SETPOINT ADJUSTMENT object changes
- After download
- One minute after power on

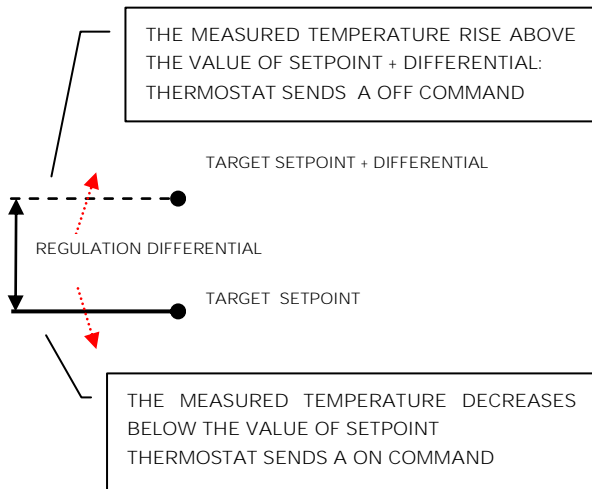
### Two points on/off

**Control algorithm "2 points on / off" is used to control heating or cooling elements that can be controlled by switching on and off of the same elements, radiators, under floor heating with on-off valves, boilers, etc. ..**

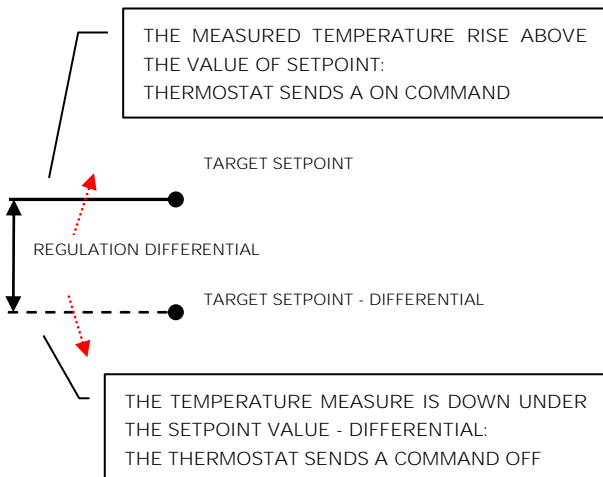
When the thermostat switches to "winter mode" (heat mode) sends a off command on object ON/OFF COOLING and operates the control only through the object ON/OFF HEATING (the object ON/OFF COOLING is therefore not updated anymore until it returns in "cooling mode").

Therefore in the transition from " winter" to "summer" mode sends a off command on ON/OFF HEATING commands and activates the control through the object ON/OFF COOLING

on/off control in heating mode:



on/off control in cooling mode:



### Integral proportional control PWM

Integral proportional control with PWM is an algorithm that reduces the effects of hysteresis around the set point value by adjusting the controls on the values ranging from 0% to 100% where 0% means "control off" and 100% means "maximum control action".

Once a cycle time is defined the thermostat sets the actuator to ON for a fraction of the cycle time and OFF for the remaining part. Driving the actuator with the control value of 80% means that it is active (i.e., ON) for 80% of cycle time and OFF for the remaining 20%

KNX PARAMETER	SETTINGS
Cycle time (TCp)	10, 20, 30, 60 min
It defines the time interval.	
Proportional band (Bp)	1, 2, 3, 4, 5 °C
The proportional band BP is a range of temperatures between "Setpoint" and "Setpoint-Bp" in heating mode and between "Setpoint" and "Setpoint+Bp" in cooling mode, within this interval thermostat controls the temperature using the proportional algorithm; outside It drives actuator always in ON or OFF. When temperature is inside this range device wait the end of the cycle time before calculating the duty cycle of the next cycle. When temperature is outside of this range : below "Setpoint-Bp" in heating mode or above "Setpoint+Bp" in cooling mode it starts a new cycle as soon as temperature enters the Bp	
Integration time (Ti)	5 .. 250 min
Defines the integration time	

### Integral proportional contr. continuous

This setting is very similar to "Integral proportional control with PWM" in terms of algorithm and parameters. This mode uses a 1 byte object (% value) to send the command on the bus .

### Fan coil on/off

Fan coil is a device that controls the flow of cooling / heating liquid driving a valve (2-pipe fan coil) or two valves (4-pipe fan coil).

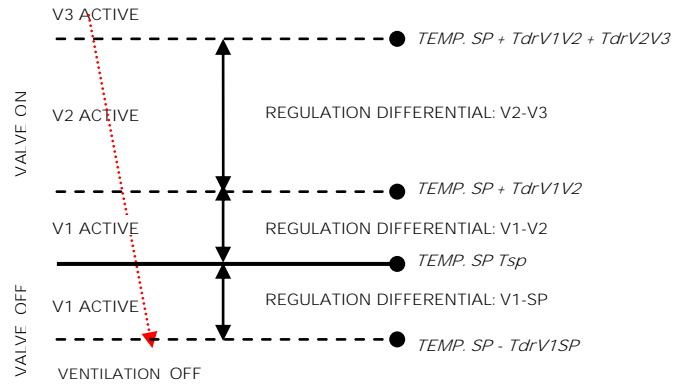
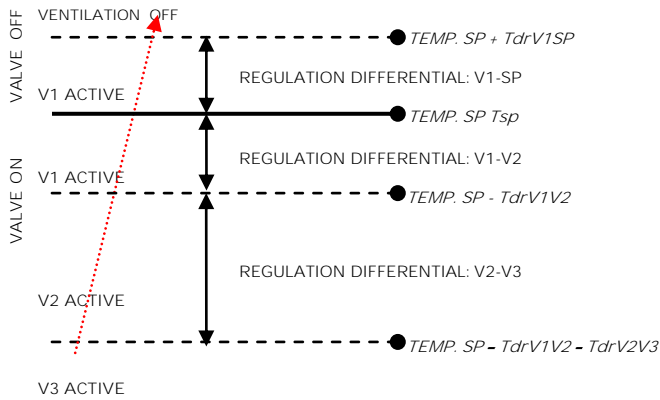
Liquid exchanges heat/cool with the environment through a ventilation system controlled by a fan. The fan is driven by an engine that typically has 3 windings that can be enabled at 3 distinct speeds.

Control logic for a 3 speed fan coil in heating:

Control logic for a 3 speed fan coil in cooling:

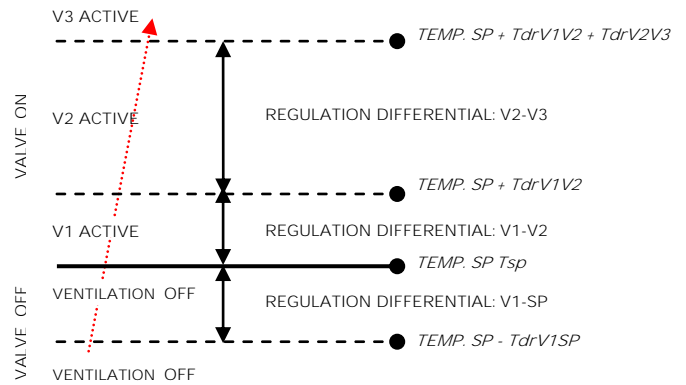
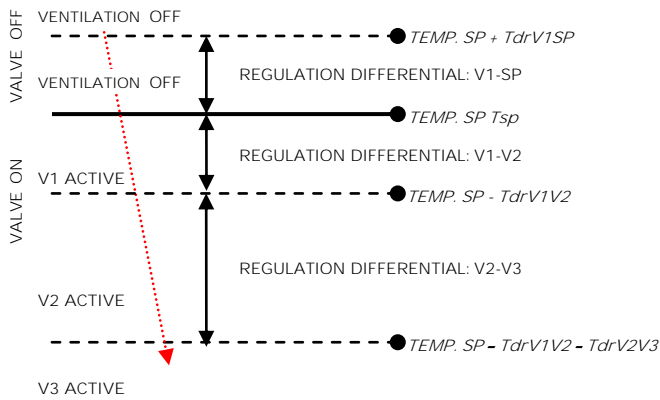
When temperature increasing

When temperature decreasing



When temperature decreasing

When temperature increasing



Where:

Where:

- $T_{sp}$  : Target setpoint temperature
- $T_{drV1SP}$  : regulation differential in heating for V1-SP
- $T_{drV1V2}$  : regulation differential in heating for V1-V2
- $T_{drV2V3}$  : regulation differential in heating for V2-V3

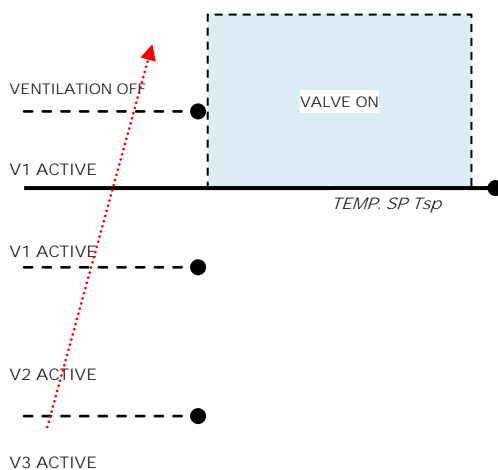
- $T_{sp}$  : Target setpoint temperature
- $T_{drV1SP}$  : regulation differential in cooling for V1-SP
- $T_{drV1V2}$  : regulation differential in cooling for V1-V2
- $T_{drV2V3}$  : regulation differential in cooling for V2-V3



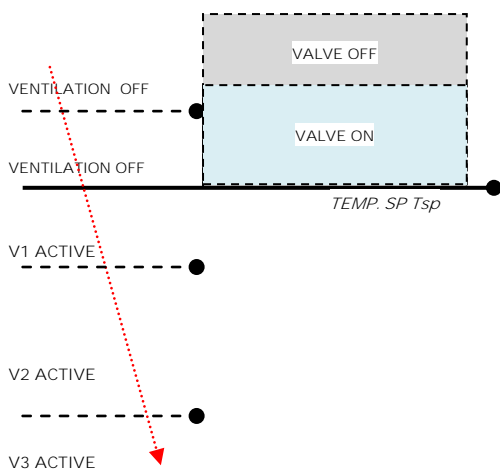
## Fan coil control PI

### Manage valve independently

In Fan coil on / off mode it is possible to have the opening or closing of the valve independent from switching on or off the speeds by setting the parameter "manage valve independently". This makes valve adjustment differentials visible and can be set different from those set for speeds. The valve can therefore be kept open even when the fans are stopped.



The shaded area represents the temperature range defined by the "heating control differential ON" parameter in case of increasing temperature. When the temperature decreases, the "heating control differential ON" parameter defines the valve hysteresis.



Logic and parameters are the same used in On/off with PWM control mode; the difference is that now the proportional value is sent to the bus via a 1 byte object format as a % value from 0% to 100%.

This mode is useful to control fan coils (selecting 2 or 4 pipes) or generic proportional actuators as valve drivers only linking the 1 byte communication object and avoiding to link the valve objects.

### CONTINUOUS CONTROL object

This 1 Byte object send % control value to actuator.

### Additional valve



In fan coil mode it is possible, in 4 pipes systems to enable an additional valve object.

This object is used when the thermostat has to manage 2 different system , one in heating and one in cooling .

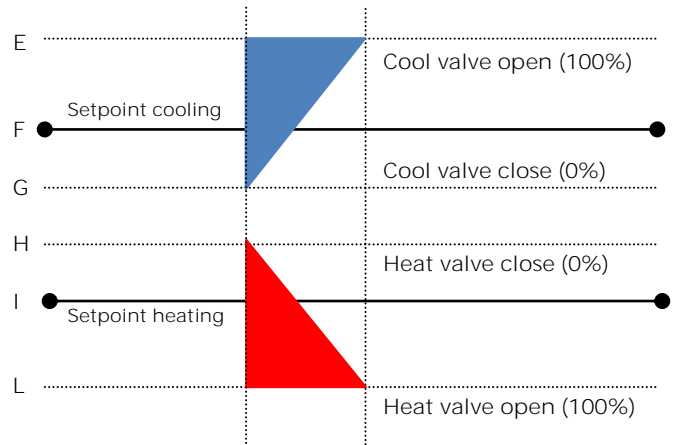
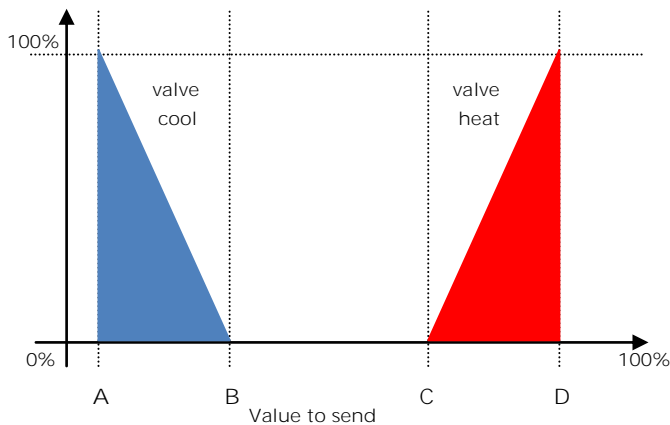
Suppose to have a system when floor heating is required in heating mode and a 3 speed fan coil system is required in cooling mode.

To manage this system it is necessary to :

- Set parameter "Thermostat option > use thermostat to control fan coil" = yes
- Set parameter "Fan coil ON - OFF control>Enable fan speed on" or "Fan coil continuous control > Enable fan speed on" =cooling
- Set parameter "Fan coil ON - OFF control > System type" or "Fan coil continuous control > System type" = 4 pipes
- Set parameter "Enable additional valve"=enabled
- Set parameter "Additional valve>Enable valve when"=heating
- Set parameter "Additional valve>Control algorithm" = *according to your system request*

## Additional valve 6 ways

The additional valve also manages commands for 6-way valves in which the control value from 0% to 100% defines both the percentage of valve opening and the passage of hot or cold fluid.



This makes it possible to adjust the opening and closing of the additional valve independently of the speed control (for example, once the setpoint has been exceeded, a maintenance action can be taken keeping the valve open again without activating the speeds)

KNX PARAMETER	SETTINGS
Percentage 100% cool	0% ÷ 30%
Value to be sent to bring the cold valve to 100% open position [point A on the diagram]	
Percentage 0% cool	23% ÷ 53%
Value to be sent to bring the cold valve in closed position (0% open) [point B of the diagram]	
Percentage 0% heat	47% ÷ 77%
Value to be sent to bring the hot valve to the closed position (0% open) [point C of the diagram]	
Percentage 100% heat	70% ÷ 100%
Value to be sent to bring the hot valve to 100% open position [point D on the diagram]	
Value to send for valve fully closed	36% ÷ 66%
Value to be sent to bring both the cold and hot valves to the fully closed position. [area of the diagram between B and C]	

For the additional valve, in 6-way mode, it is possible to define different control differentials around the setpoint value as shown below:

KNX PARAMETER	SETTINGS
Regulation differential valve 0%	0°C ÷ 5 °C
Defines the width of the F-G bands for cooling and H-I for heating	
Regulation differential valve 100%	0°C ÷ 5 °C
Defines the width of the E-F bands for cooling and I-L for heating	

## Force fan coil speed

In fan coil operation (in 1-bit or 1-byte mode), you can force the use of just one speed and bypass the automatic speed selection. This mode is useful, for example, in small rooms such as hotel rooms, for example or in any case where the fan speed may bring noise. To activate forcing, you must act on the 1-bit object that selects AUTO / MAN and then on the object that activates the desired speed (3x1 1-bit object or 1 object at 1-byte in% mode)

## Ventilation mode

When using fan coil, you can also activate "fan" or "ventilation" mode. In this mode, the fan coil will

never turn off the fan even when, after reaching the desired setpoint, the heat / cool valve closes. To select the fan speed used in ventilation mode the **"force fan speed object" must be set, in fact in AUTO** mode the ventilation stops when setpoint is reached. It is also possible to make the "ventilation" mode always active without having to turn it on / off via a communication object.

## 2nd Stage Object

The 2nd Stage object is an additional control object for the regulation of a second heating or cooling equipment; a 1-bit or 1-byte control can be set for this object; if the control is a byte it is possible to set PI control (Proportional Integral). With the "Bandwidth" parameter you set how much the current setpoint is shifted to manage the switching on and off of the equipment controlled by the 2nd stage object. For example, if the setpoint is 20 ° C and "Bandwidth" is set = 1 then the setpoint for the part controlled by the 2nd stage object will be 20-1 = 19 ° C; vice versa if "Bandwidth" is = -1 then the 2nd stage setpoint will be 20 - (- 1) = 20 + 1 = 21 ° C.



If the equipment controlled by 2nd Stage is a 1,2 or 3-speed fan coil it is suggested to set the 2nd stage as 1 Byte and to send the control value % in the logic called "proportional speed/fancoil conversion" to have 1 bit output objects for the 3 speeds.

## Temperature probe failure / out of range measurement



If the temperature probe is disconnected or in short circuit the control action is interrupted and the controlled actuators are switched off.



The value of temperature sent on the bus in case of probe disconnection or short circuit or for out of range measured value is 0 °C (according to KNX DPT\_Value\_Temp 9.001)

## Temperature alarm object

Alarm objects are available for each thermostat and for each temperature probe; in case of probe failure or out of range measurement, a telegram with value "1" is sent to the bus on a 1-bit communication object; as soon as the temperature sensor is operating again, the value "0" is transmitted.

To correctly manage the internal or rear sensor or KNX sensor via bus, refer to the following configuration modes:

CONFIGURATION MODE 1
<b>Only probe connected to input</b>
if the temperature probe is disconnected or short-circuited, the monitoring action is interrupted and the controlled actuators are deactivated.
probe / short circuit disconnection / out of range measurement:
Obj "Temperature" is not send
Obj "Alarm" send "1"

CONFIGURATION MODE 3
<b>Only KNX temperature via bus</b>
The KNX probe is read considering the last value received on the Obj "KNX probe temperature".
If the KNX probe value is out of range or the monitoring time expires:
Obj "Alarm" send "1" until KNX temperature is received again.

CONFIGURATION MODE 3
<b>Mix of probe connected to input and KNX temperature via bus</b>
The KNX probe is read by considering the last value received on the OBJ "KNX temperature probe".
The value of the temperature sent on the bus is the weighted average between the values of the front probe and KNX.
If the value of the KNX probe is out of range or the monitoring time expires without having received any message, the thermostat starts by considering only the other probe until it receives a new valid value from the KNX probe; in this case the bus value is again considered.

## 10. Thermostat behaviour on bus failure, recovery and download

### Behaviour on bus voltage failure

On failure of bus voltage no actions are executed by the device; behaviour of controlled actuators must be set using their own parameters.

### Behaviour on bus voltage recovery

On bus voltage recovery all the communication objects are set to 0 except for objects for which a parameter is defined for the initial value; thermostat keeps these values in memory and restore them after recovery:

- Heat / Cool mode
- HVAC Mode
- Base Setpoint
- Setpoint Adjustment
- Force value in manual mode
- Ventilation

Control values (i.e. commands to actuators) are calculated using actual setpoint and temperature.



After power on device recalculates the commands to actuators and switch them on, if necessary, otherwise does not carry out any action; you are recommended to set the behaviour of actuator in order to switch the heating / cooling equipment off after bus power on.

### Behaviour on ETS Download

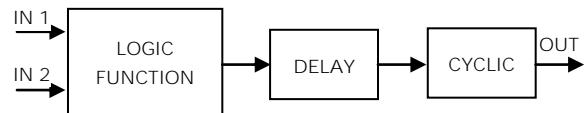
After download it's possible to set initial value of:

- Heat / Cool mode
- HVAC Mode
- Ventilation

For other communications objects the behaviour is identical to bus voltage recovery.

## 11. Logics

The logic functions are organized into groups of 3 objects: 2 inputs and 1 output, except the one called "logic expression" that will be described later. The scheme of logics is as follows:



### Inputs

Input datatypes can be bit, byte, float etc according to the selected logic.

IN1 is always present. IN2 maybe unused (or hidden directly by ETS).

### Delay

The logic output can be delayed according to the ETS parameter, if a new value is received, the output is overwritten and the delay reset.

### Cyclic

The delayed output can be retransmitted n times according to ETS parameters

### Logic function

Logic function type is defined by an ETS parameter; here the list of functions:

FUNCTION NAME	DESCRIPTION
Disabled	The logic block is disabled, no parameter / object is visible.
bit no transfer	Only delay and retransmission. IN1 is a bit. IN2 is disabled. OUT is a bit.
byte no transfer	Only delay and retransmission. IN1 is a byte. IN2 is disabled. OUT is a byte.
bit NOT	OUT = NOT IN1 IN1 is a bit. IN2 is disabled. OUT is a bit.

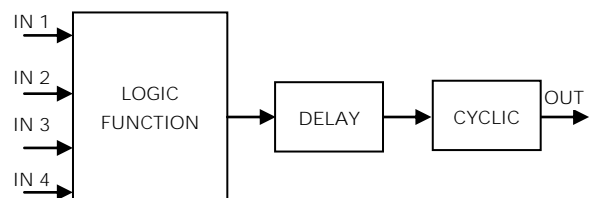
bit AND	OUT = IN1 AND IN2 IN1 is a bit IN2 is a bit OUT is a bit.
bit OR	OUT = IN1 OR IN2 IN1 is a bit IN2 is a bit OUT is a bit.
bit NAND	OUT = NOT (IN1 AND IN2) IN1 is a bit IN2 is a bit OUT is a bit.
bit NOR	OUT = NOT (IN1 OR IN2) IN1 is a bit IN2 is a bit OUT is a bit.
bit XOR	OUT = IN1 XOR IN2 IN1 is a bit IN2 is a bit OUT is a bit.
bit XNOR	OUT = NOT (IN1 XOR IN2) IN1 is a bit IN2 is a bit OUT is a bit.
bit to byte conversion	2 ETS parameters: BYTE_0, BYTE_1. When 0 is received, BYTE_0 is sent. When 1 is received, BYTE_1 is sent. IN1 is a bit. IN2 is disabled. OUT is a byte.
byte to bit conversion	1 ETS parameter: BYTE_V. When a value equal to BYTE_V is received then a telegram 0,1, or nothing is sent. When a value different from BYTE_V is received then a telegram 0,1, or nothing is sent IN1 is a byte. IN2 is disabled. OUT is a bit.
byte threshold	1 ETS parameter: BYTE_V. When a value less or equal to BYTE_V is received then a telegram 0,1, or nothing is sent. When a value greater than BYTE_V is received then a telegram 0,1, or nothing is sent IN1 is a byte. IN2 is disabled. OUT is a bit.
2 byte float threshold	1 ETS parameter: 2BYTE_F. When a value less or equal to 2BYTE_F is received then a telegram 0,1, or nothing is sent. When a value greater than 2BYTE_F is received then a telegram 0,1, or nothing is sent IN1 is a 2 bytes float. IN2 is disabled. OUT is a bit.
4 byte float threshold	1 ETS parameter: 4BYTE_F.

	When a value less or equal to 4BYTE_F is received then a telegram 0,1, or nothing is sent. When a value greater than 4BYTE_F is received then a telegram 0,1, or nothing is sent IN1 is a 4 bytes float. IN2 is disabled. OUT is a bit.
proportional fancoil	This logic is to have a thermostat where you can set Temperature, Setpoint and Mode (Heat or Cool) and it calculates the output value % and send it on the bus with 1 Byte Object. Parameters are: Dead Band; Proportional band; control type (P or PI); system type (1 valve or 2 valves)
proportional / speed fancoil conversion	This logic is to convert a 1 byte value % (given by a thermostat) into a 3x1 bit object speed control value to manage fan coils. By setting the parameter <b>"proportional conversion"</b> it can be also a conversion from 3x1-bit object speed into a 1 byte object value %
dew point humidistat	This logic is to calculate the dew point given relative humidity , temperature,
expression	See next paragraph

### Expression

Logic expression can be used to implement custom logic and arithmetic operation between values received on the KNX bus.

The logic expression has 5 objects: 4 inputs and 1 output. The scheme of logic expression is as follows:



Inputs (A, B, C, D) and output (OUT) objects

The datapoints can be configured through an ETS parameter:

- bit
- unsigned byte
- signed byte
- unsigned 2 bytes
- signed 2 bytes

- float 2 bytes (eg. temperature, humidity, ...)
- unsigned 4 bytes
- signed 4 bytes
- float 4 bytes (eg. power, energy, ...)

#### Expression

Configurable through an ETS parameter of 16 (maximum) character string. The output of the logic is the arithmetic evaluation of this expression. Inputs objects can be accessed through their letters (A, B, C, D), the result is sent to the delay block.

#### Permitted operands:

"+"	arithmetic sum
"-"	arithmetic subtraction
"*"	arithmetic multiplication
"/"	arithmetic division
"&"	logic AND
" "	logic OR
"^"	logic XOR
"!"	logic NOT
">"	greater than
"<"	less than
"="	equal to
"?" ":"	ternary conditional
"(" and ")"	grouping operands

#### Ternary conditional:

*<condition> ? <expression1> : <expression2>*

Where:

*condition* is the expression to be evaluated.

*expression1* is evaluated when *condition* is TRUE

*expression2* is evaluated when *condition* is FALSE

*expression1* or *expression2* can be "N" when "no expression has to be evaluated"

#### Expression examples:

"(A+B+C)/3"	calculate the mean of the A, B, C objects
"A*9/5+32"	convert object A Celsius degrees to Fahrenheit degrees
"A*1000"	convert object A KW to W
"A*3.6"	convert object A m/s to Km/h

- Quotation marks must not be included in expressions

- If wrong or unrecognized characters are used in expression then it will be not processed and discarded.

## 12. Virtual holder

Virtual holder is activated by enabling corresponded **parameter in page "General Settings"**.

The application field is typically the hotel room where, by using this feature, you can remove the Holder for access control.

This logical module provides a set of parameters and communication objects that, suitably configured, allow you to set up whether or not a person is occupying the room.

#### Definitions:

VH = Virtual Holder

CO = Communication Object

IN = CO receiving telegram from the bus

OUT = CO sending telegram on the bus

Welcome = event triggered when someone enters the room which was not occupied

Goodbye = event triggered when the room goes in **status "unoccupied"**

#### How it works

When one or more people enter the room, that event is recognized by the door opening and if, after it is closed, the customer's presence is still identified, then the logical module decides that the client is in the room otherwise it determines that he is out of the room. The minimum set of sensor requested for this logic to work properly is:

- one door contact for each door of the room, this contact must be detected by a KNX device in **order to send on the bus the value "0" when door is closed and value 1 when door is opened**
- at least one presence detector for each area; this presence detector can be KNX or conventional with dry contact output to be connected a KNX input. This device must send on the bus the **value "1" when presence is detected and value 0 when presence is not detected.**

## Communication Objects

maintenance.

## Parameters - General

<VH> Room Booked	IN	1 bit
By setting this CO to "1" the status of the VH is set to "room booked"; when set to "0" the status is "room not booked". The VH module can have different behaviour if the room is booked or not; default value for this status can be set using the "Booked state after download" parameter.		
<VH> Signal for guest (Type1)	IN	1 bit
<VH> Signal for service (Type2)	IN	1 bit
<VH> Signal for maintenance (Type3)	IN	1 bit
This COs can be used to communicate to the VH module who is entering the room. This can be achieved by using a KNX Access Control Reader ( <i>Synchronicity</i> by eelectron) or by interfacing other access systems with KNX bus		
<VH> Presence for guest (Type1)	OUT	1 bit
<VH> Presence for service (Type2)	OUT	1 bit
<VH> Presence for maintenance (Type3)	OUT	1 bit
This COs can be used to send from VH module information about who entered the room to a supervisor or similar sw.		
<VH> Remote Inputs Enabled (Global Enable)	IN	1 bit
See paragraph Remote Sensor inputs (Global Enable).		
<VH> Presence Output	OUT	1 bit
This CO send "1" when someone is detected inside the room (presence) and "0" when nobody is detected inside the room and the "presence wait time" has expired (absence).		
<VH> HVAC Output	OUT	1 byte
This CO is used to send HVAC commands in event of presence and absence. Commands can be set different if the room in booked or not and if the person who enter the room is guest, service or maintenance.		
<VH> Additional Output	OUT	1 byte
This CO is used to send commands in event of presence and absence. Commands can be set different if the room in booked or not and if the person who enter the room is guest, service or		

KNX PARAMETER	SETTINGS
Presence wait time	1 min to 3 hours
This parameter set the "wait time" for the VH module. The "wait time" is the time triggered by the opening and consequent closing of the door. During this time the room is in "wait " mode and after this can go in "occupied" or "non occupaied" status.	
Use values for this parameter that are not too small to avoid not recognizing people in the room and not too big to avoid to kkeep room service active for too long after customers leave.	
Cyclic presence send time	No cyclic send, 1 min to 1 hour
Object <VH> Presence Output can be send cyclically if this parameter is set different from "No cyclic send".	
Presence sensor OFF latency	10 to 63 sec.
This parameter is related to the time set on the presence detector. The most of presence detectors keep the presence status for a configurable amount of seconds; set this parameter to the same value. It's recommended to set this time duration at the minimum.	
If the presence detector is a conventional one (dry contact output connected to a KNX input) this time duration is the relay time. If the knob of the conventional presence detector is set to 10 sec. then set this parameter to 10 sec. as well.	
Send welcome on unexpected presence	do not send / send
This parameter defines the behaviour when the VH module detects a presence inside the room and is in "not occupied" status (unexpected presence ). It's possibile to send or not the welcome event.	
Global enable state after download	disabled / enabled
See paragraph Remote Sensor inputs (Global Enable).	

Booked status after download	not booked / booked
Set the initial value for the object <VH> Room Booked	
Absence with door open (deny=if door open presence is active)	allow / deny
This parameter defines the behavior when the VH module detects the open port. If the door remains open longer than the wait time, this parameter defines whether to keep the room in "occupied" state or not.	

## Parameters - Remote inputs

In this page the installer must set which type of sensor are linked to the VH module

KNX PARAMETER	SETTINGS
Remote input <x>	disabled door presence bus sniffer

disabled: non used  
 door: set this option if the communication object <VH> Remote Input x Door is linked to a door contact KNX input.  
 presence: set this option if the communication object <VH> Remote Input x Presence is linked to a presence detector KNX communication object.  
 Bus sniffer: set this option if the communication object <VH> Remote Input x Sniffer is linked to a generic CO used in the room.



### Usage of the Bus Sniffer Option.

When a person occupies a room interacts with it. Turning on or off a light in the main room or in the bathroom gives indication of the presence of people inside the room. To reduce the risk of not correctly identifying the "occupied room" status, it is recommended to connect a "bus sniffer" input to all the 1 bit objects that can be sent to the bus only by the presence of a person in the

room such as bathroom or mirror lights or window contact or bedside light, etc ....



### WARNING ON REMOTE INPUT <X> CO

- a Remote Input CO (type door) must be connected only to one single door contact on/off telegram;
- a Remote Input CO (type presence) must be connected only to one single device with presence on/off telegram;
- a Remote Input CO (type bus sniffer) can be connected to more than one devices.

Local input	disabled door presence
-------------	------------------------------

Local input can be connected either to a door contact or conventional presence detector ; by **setting this input as "digital input" and "activation press/release" it's possibile to send also telegram on the KNX bus for other purposes.**



## Remote Sensor Inputs (Global Enable)

This CO is used when you need to consider 2 adjacent rooms as separated or joined as if they were a single room (suite room).

This possibility must be considered during installation, so communication objects must be connected as described below if you want to switch runtime from one configuration (2 single rooms) to another (one double room) and vice versa.

To handle this situation both "Virtual Holder" modules of the 2 single rooms must be activated and configured.

The principle is to connect the sensors (door, presence and sniffer) of room 1 to room 2 and vice versa; however, the "Subordinate to Remote Inputs Enable" parameter for each single Remote Input should be properly configured.

For sensors located in Room 1, this parameter must be set to "not subordinate" on room 1 "Virtual Holder" while should be "subordinated" to room 2 Virtual Holder.

The same principle must be applied to room 2 sensors that are "subordinate" only for the connections to room 1.

Setting the value "1" on the "Remote Inputs Enable" object for the "Virtual Holder" of each room each module will consider all sensors connected to it; by setting this CO to "0" each "Virtual Holder" only considers the sensors connected to its "remote inputs" set as "not subordinate"

For a connection diagram of this function see Fig. 2

## 13. Wrong application download

If the wrong ETS application is downloaded then KNX/EIB led starts blinking and device is not operative on the bus. A power reset must be done or the correct ETS application must be downloaded.

DIAGRAM OF LOGICAL CONNECTIONS FOR VIRTUAL HOLDER LOGIC MODULE

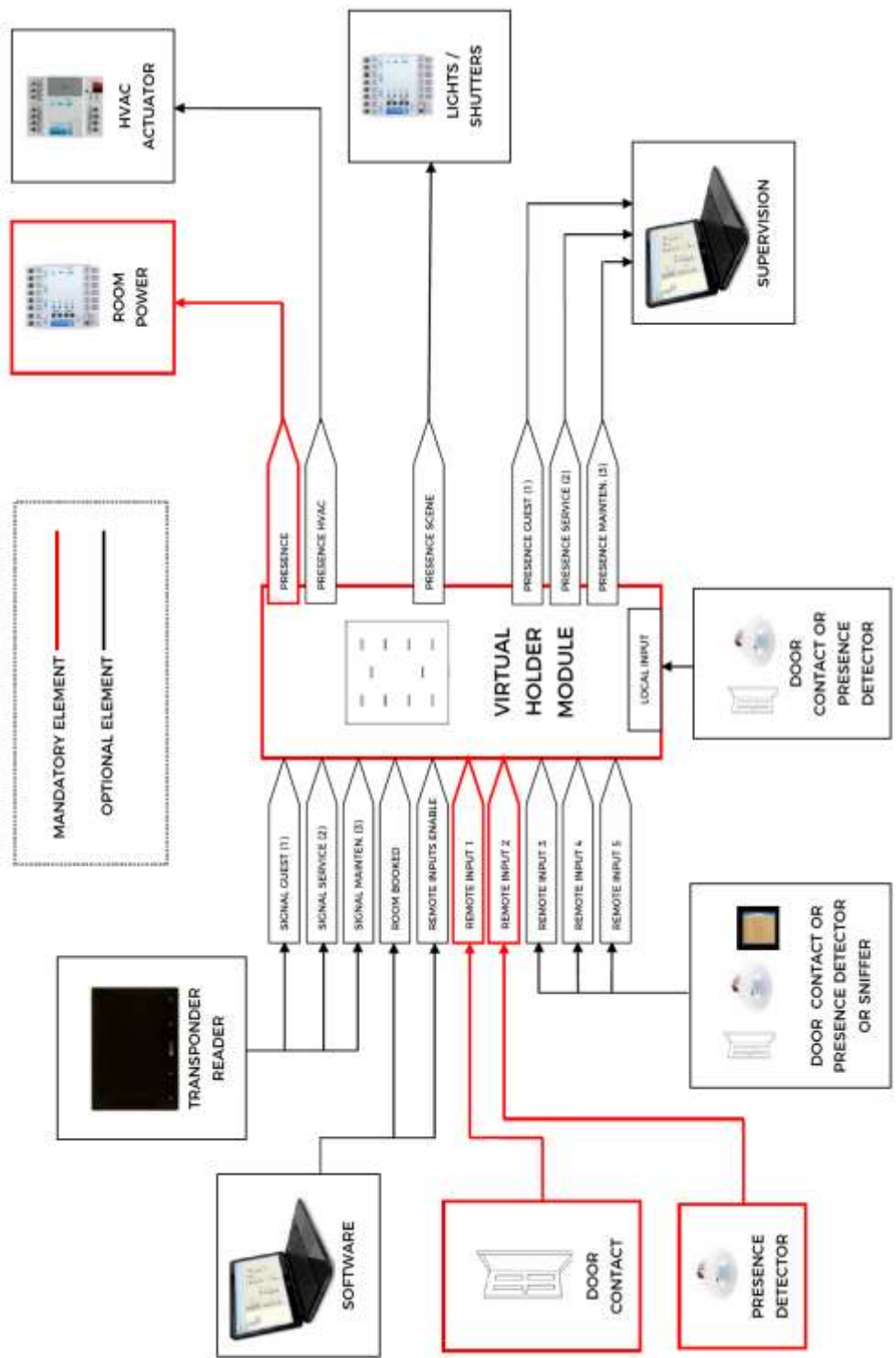


DIAGRAM OF LOGICAL CONNECTIONS FOR REMOTE SENSOR INPUT ENABLE  
(GLOBAL ENABLE)

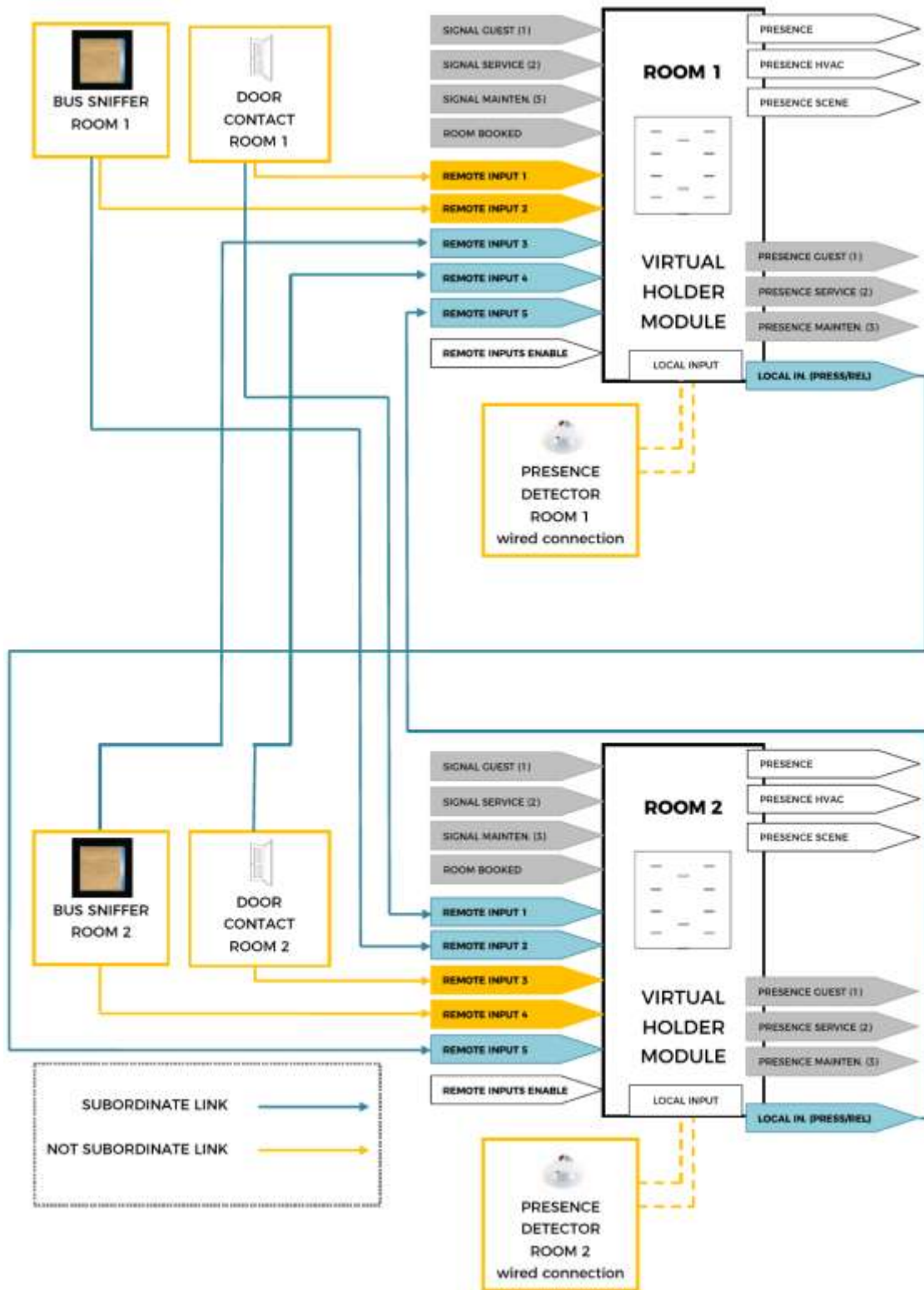


FIG. 2